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SUBJECT: AS-503/CSM 103 (Apollo 8)
Launch Preparations,
Launch Countdown, and
Flight Sequence of Events
Case 320

DATE: November 22, 1968

FROM: G. J. McPherson Jr.

ABSTRACT

This memorandum is a collection of data concerning the launch countdown preparations, launch countdown, and flight phases of the Apollo 8 mission.

Included are descriptions of SV preparations commencing with the Flight Readiness Test (FRT), CDDT, launch opportunity and launch window constraints, a sequential listing of significant launch countdown and flight events, hold/recycle capabilities within the launch countdown, and projected scrub-turnaround times.

A description of the SV and launch facility configurations just prior to entering the 102-hour launch countdown phase is also included.

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LAUNCH PREPARATIONS, LAUNCH COUNTDOWN, AND
FLIGHT SEQUENCE OF EVENTS (Bellcomm, Inc.)
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MEMORANDUM FOR FILE

1.0 INTRODUCTION

This memorandum contains an accumulation of data concerning the launch preparations, launch countdown, and flight phases of the Apollo 8 mission. The data, which has been extracted from various documents* published by MSFC, MSC, and KSC in support of Apollo 8, includes only that which has been deemed of major interest and significance by the author.

The purpose of this memorandum is to allow increased familiarization within MA of the Apollo 8 mission which has the following unique aspects over previous Apollo Program missions:

1. first manned mission to be launched on a Saturn V LV
2. first Block II SC to be launched on a Saturn V LV
3. first Saturn V launch countdown involving crew functions
4. first Apollo launch constrained by lunar launch opportunity and lunar launch window considerations
5. first Saturn V SV to use a split CDDT (wet/dry) for countdown rehearsal
6. first S-IVB to utilize the H_2/O_2 gas burner for propellant tank repressurization prior to engine restart
7. first lunar oriented mission for an Apollo SC
8. first S-IVB to be injected into a lunar "slingshot" trajectory
9. first Saturn V to be flown with open-loop PU systems (S-II and S-IVB)
10. first Saturn SV to utilize flyaway SLA panels

*See References.

2.0 PREPARATIONS FOR LAUNCH COUNTDOWN PHASE

SV processing activities for AS-503/CSM 103 will be similar to AS-502/CSM 020 in that the CDDT will be the last major test event prior to starting the launch countdown phase. It will not, however, be used to perform actual countdown preparations to the extent it was on Apollo 4 since the two events are not planned to occur "back-to-back." This resulted from inserting a planned slack period (~4 days) after completion of the CDDT to acquire added confidence in "launching-on-date." It is intended that this built-in contingency time would be capable of absorbing any delays resulting from pad testing and still allow the first attempted T-0 to occur at the opening of the first window within the Apollo 8 launch opportunity.

Figure 1 reflects the major pad activities planned for AS-503/CSM 103 commencing with the FRT and continuing through the launch countdown. The FRT will consume three days of pad schedule for the actual test with another two days (non-serial) required for data evaluation.

Subsequent to the FRT simulations, but in parallel with FRT data evaluation, SV hypergolic loading preps will commence. Assuming that FRT data evaluation verifies Apollo 8 is ready for launch, hypergolic loading will immediately follow completion of the loading preps.

Upon completion of SV hypergolic loading, S-IC RP-1 loading will commence in parallel with SC preparations for CDDT. As soon as RP-1 has been loaded, the F-1 engine main fuel valve leak checks will be performed. The SV is now ready to enter the CDDT.

The CDDT for Apollo 8 will be very similar to that performed on Apollo 7 (AS-205/CSM 101). The CDDT will consist of two distinct exercises, the first being a "wet" test and countdown rehearsal without flight crew participation; the second will be an abbreviated countdown including flight crew participation atop a "dry" LV.

The two CDDT's will be scheduled back-to-back with T-0 for the dry test scheduled to occur 24 hours after the wet T-0.* Table 1 lists some of the more significant hardware and procedural differences between the two CDDT exercises. Figure 2 provides a timeline of major activities during the CDDT phase.

*A slip in the wet T-0 will not necessarily mean a corresponding slip in the dry T-0. The wet T-0 will be planned for the same time-of-day as launch T-0.

Upon completion of the dry CDDT, the MSS will be returned to the pad and the SV deconfigured from CDDT. Final LV and SC preparations/inspections will then be performed prior to the SV entering the planned slack period for launch-on-date considerations.

The slack period which could be as long as seven days in duration (providing none of it has been used to absorb prior delays) will be a period of monitoring and minimum activity. At the completion of the hold period, the 102-hour launch countdown phase will commence.*

3.0 LAUNCH WINDOW AND LAUNCH WINDOW CONSTRAINTS

Apollo 8 will be the first Apollo SV to be launched within the constraints of a lunar launch opportunity and lunar launch windows. Although the lunar launch opportunity for Apollo 8 during the month of December opens on the 20th and closes on the 27th, the 20th was discarded as the first window because of launch/recovery area lighting constraints. Should it become necessary to delay the launch attempt until January, a corresponding lunar opportunity would be available between the 18th and the 24th.

Figure 3 provides a graphic view of the overall launch opportunity, the seven approved launch windows within the opportunity, and the time-of-day (EST) vs launch azimuth throughout each window.

The December launch opportunity is limited to the total number of days (launch windows) which satisfy the following launch window criteria:

1. launch azimuths must be between 72° and 108°
2. must allow a free-return circumlunar trajectory
3. must provide acceptable lighting within the Apollo zone and allow Pacific Ocean injection
4. must be a daylight launch (between 30 minutes prior to sunrise and 30 minutes after sunset)

*Launch countdown precount operations may commence during the slack period as added assurance for arriving at T-0 at the scheduled time.

The plots of Figure 3 indicate the opening and closing of each of the seven December launch windows as determined from combining the first three constraints with a particular target site within the Apollo zone. The shaded areas on either side of the figure reflect the effects of the fourth constraint which would require an early closing of the windows of December 25, 26, and 27.

Since the Apollo 8 launch will be targeted for the opening of the first window within the December launch opportunity, T-0 is anticipated to occur at 0751 hours EST on December 21, 1968.

4.0 LAUNCH COUNTDOWN PHASE

The launch countdown phase for the Apollo 8 mission is 102 hours in duration excluding the planned 6-hour built-in hold at T-9 hours. The countdown phase consists of two distinct periods of activity:

T-102 hours to T-28 hours--precount activities

T-28 hours to T-0 hours--countdown

Based on a launch window opening time of 0751 hours EST, precount activities must be initiated no later than 1951 hours EST on L-5 day. Assuming none of the 6-hour built-in hold has been used by T-28 hours, the countdown would be initiated at 2151 hours EST on L-2 day.

The 28-hour countdown commences with opening the pad for access subsequent to completion of SC cryogenic servicing. Figure 4 provides the timelines for the major SV activities during the launch countdown phase. Reference should be made to Table 2 which provides significant configuration information for AS-503/CSM 103 and LC-39 just prior to entering the 102-hour launch countdown phase.

Table 3 reflects the nominal sequence of events for the launch countdown and flight phases of Apollo 8. Although the times indicated have been extracted from the most recent issues of the referenced documents, they are not to be construed as the official nominal times for the Apollo 8 mission unless verified as being currently accurate with the authoritative MSC, MSFC, and KSC parties.

5.0 HOLD CAPABILITIES WITHIN THE LAUNCH COUNTDOWN

The hold capabilities within the launch countdown are dependent upon the T-time at which the hold is initiated. The hold capabilities for the Apollo 8 launch countdown are shown in Table 4.

6.0 SCRUB TURNAROUND TIME

The scrub turnaround time is also dependent upon the T-time of scrub initiation. The projected scrub-turnaround times for the Apollo 8 mission are shown in Table 5.

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Attachments
Figures 1-4
Tables 1-5

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REFERENCES

1. Launch Vehicle Operations for Support of Space Vehicle Countdown Demonstration Test and Launch Countdown, Volumes I-III, KSC V-20050, AS-503, Basic, dated October 28, 1968.
2. Mission Implementation Plan for Apollo 8 C Prime Mission, OMSF, dated November 14, 1968.
3. Spacecraft Operations for Space Vehicle Launch Countdown, Countdown Demonstration, FO-K-0007VI-SC 103, KSC, dated November 2, 1968.
4. Apollo/Saturn Launch Mission Rules, Apollo 8 (SA-503/CSM 103), Updated Preliminary, KSC K-V-05.10/3, dated October 22, 1968.
5. Apollo Mission C' Spacecraft Operational Trajectory, Alternate 1, Lunar Orbital Mission, Volume 1, Mission Profile for a Mission Launched December 21, 1968, MSC Internal Note No. 68-FM-252, dated October 25, 1968.
6. AS-503 C' Launch Vehicle Operational Trajectory for December 1968 Launch Window, FMT-1-68, MSFC, dated October 29, 1968.
- 7.* Apollo/Saturn V Space Vehicle Scrub/Turnaround Plan (Apollo 8), SA-503/CSM-103, KSC, 630-39-0035, dated November 1968.
8. Interface Control Document, Definition of Saturn SA-503 Flight Sequence Program, MSFC 40M33623C, dated September 24, 1968 (IRN's 34-36 attached, dated October 7, 1968).

*Not released

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TABLE 1

APOLLO 8 "WET" AND "DRY" CDDT - SIGNIFICANT DIFFERENCES

<u>Item</u>	<u>Wet</u>	<u>Dry</u>
LV Propellants		
RP-1	already on board	already on board
LO ₂ } LH ₂ }	will be loaded during the countdown	will <u>not</u> be loaded
S-IVB Hypergolics	already on board	already on board
SC Propellants		
Hypergolics	already on board	already on board
LV Pressurants	will be serviced during countdown, propellant tanks will be pressurized to flight pressures as part of auto sequence	will <u>not</u> be serviced
SC Pressurants	will <u>not</u> be serviced	will <u>not</u> be serviced
LV Ordnance	inert and/or expended ordnance will be installed at the normal countdown times	inert and/or expended ordnance still installed from wet CDDT
SC Ordnance	light ordnance will be connected and remain so through launch, heavy ordnance will <u>not</u> be rehearsed	light ordnance still installed from wet CDDT
Flight Crew	will <u>not</u> participate	will perform all preps practical and ingress at normal countdown time

Item	Wet	Dry
S/A #9	will be retracted to the 12° position at T-43 minutes; full retract will be initiated from the LCC at T-5 minutes	will be retracted to the 12° position at T-43 minutes and then immediately reconnected for the duration of the test
SC Cryogenics	will be loaded during the countdown and unloaded immediately (partial LO ₂ load will be left on for ECS usage during the dry CDDT)	will <u>not</u> be loaded, partial LO ₂ load already on board from the wet CDDT
Fuel Cells	will <u>not</u> be activated	will <u>not</u> be activated
CM Cabin	CM hatch and BPC will be closed out prior to LV cryo loading, cabin will not be pressurized	will be closed out at normal countdown times and pressurized with 60/40 mixture
MSS	will be moved to the park-site at the nominal countdown time and will remain there until after the RF compatibility tests	will <u>not</u> be returned to the pad until after the RF compatibility tests are complete
Primary damper	will be retracted	will <u>not</u> be retracted
Countdown Termination	cutoff will occur at T-8.9 seconds (time for ignition) due to ignition failure	LV will terminate the minus count at T-4 minutes, SC will continue to simulated T-0
Q-ball Cover	will <u>not</u> be removed since cutoff occurs prior to issuance of the ignition command	will <u>not</u> be removed since the countdown is terminated prior to entering the terminal count sequence

Item	Wet	Dry
Post Test	S-II LH ₂ vent valve cryo test will commence after termination of the minus count; LV cryos unload will start concurrent with the vent valve test; S/A 1 will be disconnected and reconnected during the S-IC unload operation	RF compatibility test will commence after termination of the minus count; flight crew egress will then occur while the MSS is returning to the pad

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TABLE 2

APOLLO 8 SV AND LAUNCH FACILITY CONFIGURATION
AT T-102:00:00

Structural and Facility

Space Vehicle stacked (S-IC, S-II, S-IVB, IU, SLA, LTA-B, SM, CM, and LES)

Space Vehicle "buttoned up" except for access required during the launch countdown phase

MSS in place at the launch pad and all platforms closed

Auxiliary damper connected

Primary damper disconnected

Q-ball cover on

All service arms in place and tips extended

Flame deflector in place

Tail service masts and all umbilical carriers connected

ESP and ML zero level platforms raised

ECS

Air conditioning and normal purge being supplied to the SC and LV

Propellants and Pressurants Loaded

S-IC RP-1 (102%)

S-IVB Hypergolics

SC Hypergolics

S-IVB APS Helium (≈50 psi)

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Ordnance Installed

All LV linear shaped charges and confined detonating fuses*

S-IC retrorockets*

S-II ullage rockets*

S-II retrorockets*

S-IC/S-II separation assembly*

S-II second plane separation assembly*

S-IVB ullage rockets*

S-IVB ullage rocket jettison system*

S-II/S-IVB separation assembly*

LES motors*

LES jettison motors*

LES pitch control motors and canard deploy assembly*

All CSM ordnance (connected)

All SLA ordnance except SM/LM adapter initiators
(separates CSM from SLA and activates SLA panels)

Electrical

LV and SC powered-down

Fuel cells not activated

LV batteries not installed

CM batteries not installed

RF and TM

Flight code plugs not installed in the Range Safety decoders

*Initiators/detonators are not installed

BELLCOMM, INC.TABLE 3APOLLO 8 SV NOMINAL SEQUENCE OF EVENTS*

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-102:00:00	Start SC GSE and SC power-up
T-101:00:00	SC GSE and SC power-up complete Start SC water servicing
T-100:45:00	Start fuel cell system preparations
T-100:00:00	Start S-II umbilical verifications Start S-II engine cover removal
T-98:30:00	Start TSM mechanical preps
T-95:00:00	Fuel cell system preparations complete Start fuel cell pressurization
T-94:45:00	Fuel cell pressurization complete SC GSE power-down
T-94:40:00	IU power-up LSE power-up
T-94:30:00	S-II umbilical verifications complete S-II and S-IVB power-up
T-94:00:00	Start S-II and S-IVB PU tank purge and sampling
T-92:00:00	S-II engine cover removal complete
T-90:30:00	Start S-IVB hydraulic system functionals
T-87:15:00	S-IC power-up
T-87:00:00	S-IVB hydraulic system functionals complete
T-86:30:00	TSM mechanical preps complete S-II and S-IVB PU tank purge and sampling complete LSE power-down
T-86:15:00	S-II, S-IVB, and IU power-down
T-86:00:00	Start installation F-1 engine ordnance

*The SV plus time nominal sequence of events is based on a launch on December 21, 1968 at an azimuth of 72° with TLI at the first opportunity. Notes at the end of this section define the possible variances for other launch dates/azimuths and 2nd opportunity TLI.

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<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-85:30:00	MCC/CSM OIS communication check
T-82:00:00	SC water servicing complete SC power-down
T-81:00:00	F-1 engine ordnance installation complete S-II and IU power-up
T-80:50:00	S-IVB power-up
T-80:30:00	Start SC heavy ordnance connection LSE power-up
T-80:15:00	Start LV initiator/detonator installation/connection
T-77:30:00	Perform LV S&A functionals
T-77:15:00	LV initiator/detonator installation/ connection complete S-IC, S-II, S-IVB, and IU power-down LSE power-down
T-77:00:00	SC heavy ordnance connection complete
T-76:30:00	LES remote resistance checks
T-75:00:00	Start SC GSE and SC power-up
T-74:00:00	SC GSE and SC power-up complete Start SC helium servicing preps
T-71:30:00	SC helium servicing preps complete
T-71:00:00	Start SC helium servicing
T-66:30:00	SC helium servicing complete Start SC helium line disconnect
T-66:00:00	SC helium line disconnect complete Start SC hypergolic vent line disconnect
T-65:00:00	MCC/LV OIS communication check
T-63:30:00	SC hypergolic vent line disconnect complete
T-63:00:00	Start S-II PU system megger checks Start SC mechanical buildup
T-62:00:00	Start S-IVB PU system megger checks
T-61:30:00	LSE power-up S-IC, S-II, and IU power-up
T-61:15:00	Start S-IC propulsion system functional test Start S-IC CALIPS test Start S-II engine sequential test

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-61:00:00	S-IVB power-up
T-60:45:00	Start S-IVB propulsion system functional check
T-60:30:00	Start S-II PU system final calibration S-IC propulsion system functional test complete
T-59:15:00	Start LV flight code plug installation
T-58:45:00	Start S/A pressurization tests
T-58:30:00	Start TSM pressurization tests
T-58:00:00	Start SC battery (entry, pyro, and post landing) installation/connection Start S-IVB PU system final calibration
T-57:30:00	S-IVB propulsion system functional check complete
T-57:00:00	S-IC CALIPS test complete Start S-IC pneumatic system functional test LV flight code plug installation complete
T-56:46:00	LV/GSE DRSCS closed loop checks
T-56:30:00	S-II engine sequential test complete
T-56:00:00	Activate S-IC, S-II, S-IVB and IU flight batteries
T-55:45:00	LV/Range DRSCS closed loop checks
T-54:00:00	S-IVB PU system final calibration complete S-IC pneumatic system functional test complete Start S-IVB PU facility interface check
T-53:30:00	S-IC power-down
T-53:00:00	S-IVB and IU power-down S-IVB PU facility interface check complete
T-52:30:00	S-II PU system final calibration complete Start S-II PU facility interface check Start SC cryo GSE preps
T-51:30:00	TSM and S/A pressure tests complete S-II PU facility interface check complete

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-51:20:00	S-II PU system functional test
T-51:00:00	S-II power-down
T-50:45:00	LSE power-down
T-48:00:00	SC mechanical buildup complete
T-45:00:00	Start S-IC film camera system (FCS) installation
T-42:30:00	SC cryo GSE preps complete
T-42:10:00	LSE power-up for launch
T-42:00:00	Start fuel cell activation Disconnect E/C from SC for BPC installation
T-41:00:00	S-IC power-up
T-40:10:00	S-IC FCS installation complete
T-40:00:00	Start S-IVB APS gas removal Start S-IC FCS ordnance installation/connection Start F-1 engine hypergol cartridge installation
T-38:30:00	F-1 engine hypergol cartridge installation complete
T-38:00:00	S-IVB APS gas removal complete Reconnect E/C to SC S-IC FCS ordnance installation/ connection complete S-IC power-down
T-37:00:00	Fuel cell activation complete SC battery installation/ connection complete
T-36:30:00	Start SC LH ₂ servicing
T-34:30:00	SC LH ₂ servicing complete
T-33:00:00	Start SC LO ₂ servicing
T-31:00:00	SC LO ₂ servicing complete
T-30:00:00	Start SC LH ₂ and LO ₂ tank pressurization
T-28:30:00	SC LH ₂ and LO ₂ tank pressurization complete
T-28:00:00	Start LV and SC countdown activities

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-27:30:00	Start IU battery installation Start S-IVB aft battery installation Start S-II battery installation/ connection Start S-IC battery installation
T-27:00:00	Start SC cryo GSE removal
T-26:00:00	IU battery installation complete Start S-IVB forward battery installation Start SC couch installation
T-25:15:00	Lower ESP
T-25:00:00	S-IVB aft battery installation complete
T-24:45:00	S-IC and IU power-up
T-24:30:00	S-II power-up S-IVB forward battery installation complete Start S-IC and IU battery connection
T-24:15:00	Pressurize S-IC control, purge, camera eject, and cold helium spheres to 1500 psi
T-24:00:00	Start S-IVB forward and aft battery connection S-IVB power-up S-IC battery installation/ connection complete SC cryo GSE removal complete Open MSS platform 2
T-23:30:00	IU battery connection complete SC couch installation complete Start S-IVB vacuum jacketed line checks
T-23:15:00	LV/SC hand-controller checks
T-23:00:00	S-IVB battery connection complete S-II battery installation/ connection complete
T-22:45:00	Start TSM preps for launch
T-22:30:00	Start S/A pressurization for launch

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-22:15:00	Start HDA launch preps Start S-IC RP-1 drop to F-1 MFV's
T-22:00:00	Pressurize ST-124M sphere to 1700 psi
T-21:45:00	Perform LV TM checks
T-21:30:00	S-IC RP-I drop to F-1 MFV's complete
T-21:15:00	LV power transfer test
T-21:00:00	LV flight control gain test S/A pressurization for launch complete
T-20:25:00	LV/MCC command interface test
T-20:15:00	TSM launch preps complete
T-20:00:00	Depressurize ST-124M sphere
T-19:30:00	Start SV EDS test
T-19:25:00	Start SC final stowage
T-19:00:00	SV EDS test complete
T-17:30:00	Open MSS platform 1
T-17:15:00	Start lowering LUT level platform
T-16:15:00	Open MSS platform 4 S/A #6 tip retraction
T-16:00:00	LV/Range DRSCS checks (open loop)
T-15:45:00	LUT level platform lowering complete S/A #1 tip retraction
T-15:30:00	LV/Range DRSCS checks (closed loop) Remove S/A #8 emergency egress ladder Start F-1 thrust chamber prefill
T-15:20:00	Open MSS platform 5 Start Q-ball retract cable connection
T-15:00:00	HDA launch pressurization complete S/A #8 tip retraction
T-14:30:00	SC final stowage complete Q-ball retract cable connection complete
T-13:00:00	Start LV S&A device ordnance connections
T-12:20:00	Start white room door lock installation
T-12:15:00	LV S&A device ordnance connections complete Start final LV closeout activities Open MSS platform 3
T-12:00:00	S/A #3 tip retraction S/A #4 tip retraction

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<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-11:30:00	S/A #3 retraction Start SC backup crew checks
T-11:15:00	White room door lock installation complete
T-10:55:00	Disconnect auxiliary damper
T-10:45:00	Auxiliary damper disconnection complete Jack MSS S/A #7 tip retraction
T-10:30:00	S/A #5 tip retraction S/A #2 tip retraction
T-10:15:00	Start MSS move to park-site Connect primary damper Start ESP transporter move to launch position
T-10:00:00	Start TSM final launch preps
T-9:30:00	SC A/G voice checks TSM final launch preps complete Q-ball cover retract system preps complete SC backup crew checks complete
T-9:15:00	Pressurize ST-124 sphere to 1700 psi
T-9:00:00	Start of built-in hold
↑ HOLD ↓	
T-9:00:00	End of built-in hold Arm HDA explosive release Close CM and BPC hatch
T-8:59:00	Pressurize ST-124M sphere to 3000 psi Clear pad for LV cryo loading
T-8:15:00	ESP transporter at launch position Pressurize S-II recirculation sphere to 3000 psi
T-8:10:00	Pressurize S-II engine helium spheres to 3000 psi
T-8:00:00	Pressurize S-IC purge, control, and camera eject spheres to 3200 psi Start LO ₂ facility chilldown

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-7:50:00	Close S-II LO ₂ and LH ₂ prevalues
T-7:28:00	Start S-IVB LO ₂ loading
T-7:04:00	S-IVB LO ₂ loading complete
	Start S-II LO ₂ loading
	Open S-II LO ₂ prevalues
T-7:00:00	Pressurize S-ICB cold helium spheres to 3100 psi
	Pressurize S-IVB APS spheres to 3000 psi
	Pressurize S-IVB LO ₂ and LH ₂ repressurization spheres to 3100 psi
	Pressurize S-IVB control sphere to 3100 psi
T-6:38:00	LV/MCC command interface test
T-6:27:00	S-II LO ₂ loading complete
	Start S-IC LO ₂ loading
T-4:57:00	S-IC LO ₂ loading complete
	Pressurize S-IC cold helium spheres to 3200 psi
T-4:54:00	Start S-II LH ₂ loading
T-4:40:00	S-II LH ₂ prevalues open
T-4:11:00	S-II LH ₂ loading complete
	Start S-IVB LH ₂ loading
T-3:33:00	S-IVB LH ₂ loading at 98%
T-3:30:00	LV/Range DRSCS tests (closed loop)
	Flight crew departs MSO
T-3:28:00	S-IVB LH ₂ loading complete
	Retract primary damper
	Closeout crew departs park-site
T-3:13:00	Closeout crew on station
	Start ingress preps
T-3:10:00	Pressurize S-IVB engine helium sphere to 3200 psi
T-2:40:00	Ingress preps complete
	Flight crew arrives at SC
	Start flight crew ingress

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<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-2:10:00	Flight crew ingress complete Start flight crew suit checkout
T-1:50:00	Flight crew suit checkout complete Abort Advisory System checks
T-1:40:00	Close SC hatch Start cabin purge Start SV EDS test
T-1:25:00	Cabin purge complete Start cabin pressurization and leak check
T-1:15:00	Final jimsphere release
T-1:10:00	SV EDS test complete Start Range readout of beacon #2 Cabin pressurization and leak check complete Disconnect SC cabin GSE and connect dump line Close BPC hatch
T-1:05:00	Final white room preps
T-1:00:00	Start RP-1 level adjust
T-0:55:00	LV TM checks Closeout crew depart white room
T-0:50:00	Range readout of beacom #2 complete Start Range readout of beacon #1
T-0:46:30	LV/MCC command interface check
T-0:43:00	Retract S/A #9 to 12° park position
T-0:42:00	Closeout crew arrives at park- site Arm LES pyro buses
T-0:40:00	LV/Range DRSCS closed loop test Pressurize S-IVB APS propellant tanks
T-0:35:00	RP-1 level adjust complete
T-0:30:00	LV power transfer test
T-0:26:00	Precharge POGO suppression system
T-0:25:00	Pressurize SM RCS tanks Range readout of beacon #1 complete
T-0:22:00	Start S-II start tank chilldown

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-0:16:00	Arm F-1 igniters
T-0:15:00	S/C on internal power
T-0:14:30	Start S-IVB start tank chilldown
T-0:11:00	Terminal Count Sequencer power-on
T-0:10:00	S-II LH ₂ prevalues close
	Start S-IVB thrust chamber chilldown
	Start S-IC fuel jacket topping
T-0:08:00	Start S-II thrust chamber chilldown
	Pressurize S-IC fuel tank to 2 psig
T-0:05:30	Arm S&A devices
	S-IVB start tank pressurization
T-0:05:00	S/A #9 to full retract position
T-0:04:45	S-IVB LO ₂ and LH ₂ prevalues close
T-0:04:37	S-II start tank pressurization
T-0:04:30	Arm terminal count sequencer
T-0:04:00	Astro-launch circuit on VHF and umbilical
T-0:03:10	Initiate firing command
T-0:03:07	Terminal Count Sequencer (TCS) start
T-0:03:06	Firing command
	S-II LO ₂ tank prepressurization sequence start
	S-II LO ₂ tank vents close
T-0:02:51	S-II LO ₂ tank prepressurization sequence start plus 15 secs.
	S-II LO ₂ fill and drain close
T-0:02:47	S-IVB LO ₂ tank prepressurization sequence start
	S-IVB LO ₂ tank vents close
T-0:02:32	S-IVB LO ₂ tank prepressurization sequence start plus 15 secs.
	S-IVB LO ₂ fill and drain close
T-0:01:42	S-IC hydraulic commit command

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T-0:01:37	S-IC, S-II and S-IVB fuel tank prepressurization sequence start S-IC, S-II and S-IVB fuel tank vents close S-IC RP-1 fill and drain close
T-0:01:22	S-II and S-IVB LH ₂ tank prepressur- ization sequence start plus 15 secs. S-IVB LH ₂ fill and drain close S-II LH ₂ fill and drain close
T-0:01:12	S-IC LO ₂ tank prepressurization sequence start S-IC LO ₂ tank vents close S-IC LO ₂ fill and drain close
T-0:01:00	S/A #1 reset valve inhibit command Flame deflector cooling water on
T-0:00:52	S-IC engine calorimeter purge on
T-0:00:50	Power transfer command (S-IC, S-II, S-IVB and IU) S-IC LO ₂ dome and gas generator purge on command
T-0:00:40	S-IC fuel and LO ₂ fill and drain valve open disable command S-IVB LH ₂ directional vent to flight position command
T-0:00:30	S/A #1 retract command S/A's 2, 3, 4, 5, 6, 7, 8, and TSM auto extend and reset valve in- hibit commands S-IC checkout valves to stage return position command
T-0:00:22	Guidance reference alert command
T-0:00:20	S-IC LO ₂ interconnect valves close command
T-0:00:17.2	Guidance reference release command S-IC, S-II, and S-IVB receiver PD blocked "off" command
T-0:00:16.7	S/A #2 retract command
T-0:00:08.9	S-IC ignition command

T-TIME (hrs:min:sec)EVENT

T-0:00:08.8	S-IC igniter bank No. 1 start command
T-0:00:08.7	S-IC igniter bank No. 2 start command
T-0:00:06.7	Check S-IC links burned command
T-0:00:06.6	Start engine 105 command
T-0:00:06.25	Start engine 103 command
T-0:00:05.94	Start engine 104 command
T-0:00:05.83	Start engine 101 command
T-0:00:05.78	Start engine 102 command
T-0:00:05	De-energize S-IC engine start solenoids command
T-0:00:04.1	S-IC fuel auxiliary prepressurization command
T-0:00:00.05	Thrust check command (all cutoffs inhibited except manual and lift-off failure)
T-0:00:00	Commit command (holddown arms release, arm lift-off switches) Lift-off switches activate at ~ 1.5 inches motion (umbilical carriers disconnect and S/A's 4, 5, 6, 7, and 8 retract)
T+0:00:00.4	Plus count is referenced to IU umbilical disconnect time (TB-1) Tail service masts retract at ~ 3 inches motion
T+0:00:01.4	Initiate tower clearance yaw maneuver
T+0:00:06	Lift-off failure cutoff command
T+0:00:08	Manual cutoff initiation if no lift-off
T+0:00:09	Tower clearance yaw maneuver termination
T+0:00:10	Clear tower
T+0:00:11	Pitch and roll program initiation
T+0:00:14.4	Multiple engine cutoff enable
T+0:00:29.4	Roll program termination
T+0:00:30.4	EDS cutoff enable
T+0:01:16.5	Maximum dynamic pressure

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T+0:02:04.9	S-IC two engines out auto-abort inhibit
T+0:02:05.3	Excess rate auto-abort inhibit
T+0:02:05.5	Two adjacent outboard engines out cutoff enable
T+0:02:05.6	S-IC center engine cutoff (TB-2)
T+0:02:06.2	Auto abort enable relays reset
T+0:02:06.6	Excess rate (roll) auto abort inhibit
T+0:02:21.5	S-II ordnance arm
T+0:02:21.7	Separation and retro no. 1 EBW arm
T+0:02:21.9	Separation and retro no. 2 EBW arm
T+0:02:24.9	Separation camera on
T+0:02:25.1	Outboard engines cutoff enable
T+0:02:27	Begin tilt arrest
T+0:02:31.1	S-IC outboard engines cutoff (TB-3)
T+0:02:31.6	S-II ullage rockets ignition
T+0:02:31.7	S-IC retrorockets ignition S-IC/S-II separation ordnance ignition
T+0:02:31.8	S-IC/S-II separation* S-II LH ₂ prevalves open
T+0:02:32.5	S-II engine start sequence initiated
T+0:02:33.4	S-II engine ignition
T+0:02:36	S-II ullage rockets cutoff
T+0:02:55.8	S-IC camera jettison
T+0:03:01.8	S-II second plane separation
T+0:03:07.3	LES jettison
T+0:03:12	End tilt arrest--begin iterative guidance
T+0:08:02.3	S-IVB ullage EBW arm
T+0:08:02.5	S-II/S-IVB ordnance arm
T+0:08:06.2	S-II LO ₂ depletion sensors arm

*See notes at back of this table for end conditions (altitude and velocity).

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T+0:08:06.4	S-II LH ₂ depletion sensors arm
T+0:08:40.2	S-II engines cutoff (TB-4)
T+0:08:40.4	S-IVB LO ₂ and LH ₂ prevalves open
T+0:08:40.9	S-IVB ullage rockets ignition
T+0:08:41	S-II retrorockets ignition S-II/S-IVB separation ordnance ignition S-II/S-IVB separation*
T+0:08:41.2	S-IVB engine start sequence initiated
T+0:08:44.1	S-IVB engine ignition
T+0:08:46.6	S-IVB @90% thrust
T+0:08:48.7	S-IVB ullage rockets cutoff
T+0:08:50	S-IVB ullage jettison EBW arm
T+0:08:53	S-IVB ullage rockets jettison
T+0:11:21.5	(TB-5)
T+0:11:21.6	S-IVB engine cutoff*
T+0:11:21.8	S-IVB APS ullage engines ignition
T+0:11:26.5	SC control of LV enable
T+0:11:31.6	Earth parking orbit insertion (100x100)
T+0:11:42	Begin orbital guidance
T+0:12:48.5	S-IVB APS ullage engines cutoff
T+02:41:03.1	Begin S-IVB restart preparations (TB-6)
T+02:41:03.4	SC control of LV disable
T+02:41:44.4	Start H ₂ /O ₂ burner sequence
T+02:41:51.2	S-IVB LH ₂ tank repressurization control valve open
T+02:41:51.4	S-IVB LO ₂ tank repressurization control valve open
T+02:45:22.1	S-IVB LO ₂ and LH ₂ prevalves close

*See notes at back of this table for end conditions.
(altitude and velocity).

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T+02:49:19.4	S-IVB APS ullage engines ignition
T+02:49:19.7	S-IVB LO ₂ tank repressurization control valve close
T+02:49:19.8	S-IVB LH ₂ tank repressurization control valve close
T+02:49:19.9	H ₂ /O ₂ burner shutdown
T+02:50:22.5	S-IVB LO ₂ and LH ₂ prevalues open
T+02:50:33.1	S-IVB engine restart sequence initiate (TLI burn)
T+02:50:36	S-IVB engine ignition
T+02:50:36.1	S-IVB APS ullage engines cutoff
T+02:50:38.5	S-IVB @ 90% thrust
T+02:55:55.2	S-IVB point level sensor arming
T+02:55:57.4	(TB-7)
T+02:55:57.5	S-IVB engine cutoff (TLI burn cutoff)
T+02:56:02.4	SC control of LV enable
T+03:20:33	SC separation/SLA panel jettison
T+03:22:23	Initiate station keeping
T+03:35:33	Initiate evasive maneuver
T+05:07:47.4	S-IVB passivation enable
T+05:07:57.4	Initiate LO ₂ dump
T+05:07:57.6	Initiate engine control bottle vent
T+05:08:27.4	Initiate start bottle vent
T+05:10:57.4	Terminate start bottle vent
T+05:12:27.4	Initiate stage control sphere vent
T+05:12:57.6	Terminate LO ₂ dump
T+05:12:57.8	Terminate engine control bottle vent
T+05:13:05.2	Initiate repressurization system vent
T+06:06:25.2	Terminate repressurization system vent
T+06:06:25.4	Initiate engine control bottle vent
T+06:11:07.4	Terminate stage control sphere vent

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T+06:11:25.4	Terminate engine control bottle vent
T+06:11:26.4	S-IVB passivation disable
T+09:00:00	Potential midcourse correction 1
T+28:00:00	Potential midcourse correction 2
T+47:00:00	Potential midcourse correction 3
T+61:00:00	Potential midcourse correction 4
T+69:07:29.2	Initiate LOI burn
T+69:11:35	LOI burn termination (60 x 170)
T+73:30:52.8	Initiate LOI (2) burn (circularization)
T+73:31:02.5	LOI (2) burn termination (60 x 60)
T+88:09:00	MERRY CHRISTMAS

NOTE: The following pages contain the nominal timelines for 57 and 82 hour transearth returns, respectively.

NOTE: The following timelines are representative for the 57 hour transearth return. (see next page for 82 hour transearth return).

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T+89:15:06.6	Initiate TEI burn
T+89:18:31	TEI burn termination
T+97:00:00	Potential midcourse correction 1
T+119:00:00	Potential midcourse correction 2
T+144:48:00	Potential midcourse correction 3
T+146:48:00	SC re-entry (400K ft.)
T+146:48:27.3	Enter S-band blackout
T+146:51:28.3	Exit S-band blackout
T+146:56:23.3	Baro-switch (23.3K ft.)
T+146:56:23.7	Apex cover jettison
T+146:56:25.3	Drogue chutes deploy
T+146:57:16.3	Baro-switch (10.5K ft.) Release drogue chutes
T+146:57:17.3	Main pilot chutes deploy
T+147:01:46.6	Splashdown Main chutes release

NOTE: The following timelines are representative for the 82 hour transearth return.

<u>T-TIME (hrs:min:sec)</u>	<u>EVENT</u>
T+89:04:01.9	Initiate TEI burn
T+89:06:53.2	TEI burn termination
T+104:00:00	Potential midcourse correction 1
T+113:00:00	Potential midcourse correction 2
T+147:00:00	Potential midcourse correction 3
T+169:00:00	Potential midcourse correction 4
T+171:05:31.7	SC re-entry (400K ft.)
T+171:05:59	Enter S-band blackout
T+171:09:00	Exit S-band blackout
T+171:13:55	Baro-switch (23.3K ft.)
T+171:13:55.4	Apex cover jettison
T+171:13:57	Drogue chutes deploy
T+171:14:48	Baro-switch (10.5K ft.) Release drogue chutes
T+171:14:49	Main pilot chutes deploy
T+171:19:18.3	Splashdown Main chutes release

NOTES OF INTEREST

1. Should the circumlunar mission be implemented, the pericyynthion would occur at T+69:09:29.4 and SC re-entry (400K ft.) would occur at T+136:25:18.2. Times for events subsequent to re-entry can readily be figured by using the same respective delta times from re-entry after a lunar orbital mission.
2. TB-5 start time will vary as much as 3.5 seconds with launch azimuth.
3. TB-6 and TB-7 start times will vary as much as 35 minutes with launch azimuth and launch date assuming TLI occurs at the first opportunity.* An additional possible variance of 88 minutes is possible for a second opportunity** TLI.
4. Decision points have been selected at times prior to critical events which (if performed) commit the vehicle to another phase in the "open-ended" Apollo 8 mission. Some of the decision points selected are:
 - a. go for EPO if perigee > 75 n.m.
 - b. go for TLI during first revolution in EPO
 - c. TLI +10, 25, and 90 minutes
 - d. TLI +4, 5, 6, and 25 hours, respectively
 - e. LOI-22, 8, and 1 hours respectively
 - f. LOI(2)-1 hour
 - g. TEI-1 hour
5. Predicted end conditions:

	<u>ALTITUDE</u>	<u>VELOCITY</u>
@ S-IC/S-II separation	36.5 n.m.	8,897 fps, 2712 mps
@ S-II/S-IVB separation	106 n.m.	22,378 fps, 6821 mps
@ S-IVB first cutoff	103 n.m.	25,560 fps, 7791 mps
@ S-IVB second cutoff	186 n.m.	35,519 fps, 10826 mps

*first opportunity - TLI during 2nd earth orbit

**second opportunity - TLI during 3rd earth orbit

TABLE 4

APOLLO 8 SV HOLD CAPABILITIES

<u>T-TIME</u>	<u>DETERMINING EVENT</u>	<u>HOLD CAPABILITY</u>	<u>RATIONALE</u>	<u>RECYCLE</u>
PRIOR TO T-7 HOURS 45 MINUTES	LV CRYOGENIC LOADING STARTS AT T-7 HOURS 45 MINUTES	REMAINDER OF LAUNCH WINDOW (4.6 HOURS) IF HOLDS IN EXCESS OF THE PLANNED 6-HOUR HOLD HAVE NOT BEEN CALLED	PRIOR TO START OF LOX LOADING, CLOSING OF THE LAUNCH WINDOW IS THE ONLY CONSTRAINT	NONE
AFTER T-7 HOURS 45 MINUTES BUT PRIOR TO T-22 MINUTES	S-II START BOTTLE CHILLDOWN STARTS AT T-22 MINUTES	REMAINDER OF LAUNCH WINDOW (4.6 HOURS) IF HOLDS IN EXCESS OF THE PLANNED 6-HOUR HOLD HAVE NOT BEEN CALLED	PRIOR TO START OF S-II START BOTTLE CHILLDOWN, CLOSING TIME OF THE LAUNCH WINDOW IS THE ONLY <u>HARD</u> CONSTRAINT	NONE NOTE: IF OTHER THAN A KNOWN SHORT DURATION HOLD OCCURS AFTER T-43 MINUTES, CON- SIDERATION WILL BE GIVEN TO EXTENDING S/A #9 AND CONNECTING THE WHITE ROOM TO THE CM WHICH WILL NECESSITATE RETRACTING IT BACK TO THE PARK POSITION PRIOR TO RESUMING THE COUNT

TABLE 4 (CONT'D)

APOLLO 8 SV HOLD CAPABILITIES

<u>T-TIME</u>	<u>DETERMINING EVENT</u>	<u>HOLD CAPABILITY</u>	<u>RATIONALE</u>	<u>RECYCLE</u>
AFTER T-22 MINUTES BUT PRIOR TO T-10 MINUTES	S-IVB THRUST CHAMBER CHILLDOWN STARTS AT T-10 MINUTES	17 MINUTES MAXIMUM ACCUMULATED HOLD PROVIDING THE S-II START BOTTLE CHILL-DOWN CONTINUES UNINTERRUPTED DURING THE HOLD	A HOLD OF LONGER THAN 17 MINUTES ACCUMULATED HOLD TIME WOULD ALLOW THE H ₂ TO BE LOADED AT TOO COLD A TEMPERATURE TO SUPPLY THE RE-QUIRED ENERGY AT ENGINE START	RECYCLE BACK TO T-24 MINUTES; AN ADDITIONAL 4 MINUTES HOLD IS REQUIRED PRIOR TO RESUMING THE COUNT TO ALLOW RECONFIGURING FOR S-II START BOTTLE CHILL-DOWN
AFTER T-10 MINUTES BUT PRIOR TO T-8 MINUTES	S-II THRUST CHAMBER CHILLDOWN STARTS AT T-8 MINUTES	10 MINUTES MAXIMUM ACCUMULATED HOLD PROVIDING THE S-IVB THRUST CHAMBER CHILL-DOWN CONTINUES UNINTERRUPTED DURING THE HOLD (MAXIMUM ACCUMULATED HOLD AFTER T-22 MINUTES IS 17 MINUTES)	A HOLD OF LONGER THAN 10 MINUTES ACCUMULATED HOLD TIME COULD SUBJECT THE ELECTRONIC EQUIPMENT NEAR THE S-IVB THRUST CHAMBER PRECOOLANT EXHAUST TO TEM-PERATURES BELOW THEIR ALLOWABLE LIMITS	SAME AS ABOVE

TABLE 4 (CONT'D)

APOLLO 8 SV HOLD CAPABILITIES

<u>T-TIME</u>	<u>DETERMINING EVENT</u>	<u>HOLD CAPABILITY</u>	<u>RATIONALE</u>	<u>RECYCLE</u>
AFTER T-8 MINUTES BUT PRIOR TO T-3 MINUTES 7 SECONDS	AUTOMATIC SEQUENCE (TCS) STARTS AT T-3 MINUTES 7 SECONDS	2 MINUTES MAXIMUM ACCUMULATED HOLD PROVIDING S-II AND S-IVB THRUST CHAMBER CHILLDOWNS CONTINUE UNINTERRUPTED DURING THE HOLD (MAXIMUM ACCUMULATED HOLD AFTER T-22 MIN- UTES IS 17 MINUTES, AFTER T-10 MINUTES IS 10 MINUTES)	A HOLD OF LONGER THAN 2 MINUTES ACCUM- ULATED HOLD TIME COULD SUBJECT THE ELECTRONIC EQUIPMENT NEAR THE S-II THRUST CHAMBER PRE- COOLANT EXHAUST TO TEMPERATURES BELOW THEIR ALLOWABLE LIMITS	RECYCLE BACK TO T-24 MINUTES; AN ADDITIONAL 6 MINUTES HOLD IS REQUIRED PRIOR TO RESUMING THE COUNT TO ALLOW WARMUP OF THE ELECTRONIC EQUIP- MENT NEAR THE S-II THRUST CHAMBER PRE- COOLANT EXHAUST
AFTER T-3 MINUTES 7 SECONDS BUT PRIOR TO T-16.7 SECONDS	S-IC FORWARD UMBILICAL DIS- CONNECT (S/A #2 RETRACT) OCCURS AT T-16.7 SECONDS	NONE (INITIATION OF MANUAL CUTOFF WILL CAUSE AUTO SEQUENCE CUTOFF)	THE AUTOMATIC SEQUENCE CANNOT BE HELD BUT MUST BE RECYCLED AND REINITIATED	SAME AS ABOVE

TABLE 4 (CONT'D)

APOLLO 8 SV HOLD CAPABILITIES

<u>T-TIME</u>	<u>DETERMINING EVENT</u>	<u>HOLD CAPABILITY</u>	<u>RATIONALE</u>	<u>RECYCLE</u>
AFTER T-16.7 SECONDS NOTE: CUT- OFFS WILL NOT BE CALLED FOR AFTER T-11 SECONDS PER THE LAUNCH MISSION RULES	S-IC FORWARD UMBILICAL (S/A #2) HAS DISCONNECTED	NONE (INITIATION OF MANUAL CUTOFF WILL CAUSE AUTO SEQUENCE CUTOFF)	THE AUTOMATIC SEQUENCE CAN- NOT BE HELD BUT MUST BE RECYCLED AND REINITIATED. SINCE A RECYCLE REQUIRES A MINIMUM OF 30 MINUTES (BACK TO T-24 MINUTES PLUS AN ADDITIONAL 6 MINUTE HOLD) AND THE S-IC FORWARD ELECTRONIC EQUIPMENT CANNOT BE HELD MORE THAN 10 MINUTES AFTER S/A #2 RETRACTS DUE TO LOSS OF ENVIRONMENTAL AIR, A SCRUB IS MANDATORY.	SCRUB

TABLE 5

APOLLO 8 SV SCRUB TURNAROUND TIME

<u>T-TIME OF SCRUB</u>	<u>DETERMINING EVENT</u>	<u>TURNAROUND TIME*</u>	<u>CRITERIA</u>
PRIOR TO T-28 HOURS	SC CRYOGENIC LINE AND GSE DISCONNECTION STARTS AT T-28 HOURS	COULD TARGET FOR ANY T-0 DESIRED WITHIN THE LUNAR OPPORTUNITY	THE SV WOULD ESSENTIALLY GO INTO AN EXTENDED HOLD FOR WHATEVER PERIOD OF TIME DESIRED TO TARGET FOR A NEW T-0.
AFTER T-28 HOURS BUT PRIOR TO T-8 HOURS	LV CRYOGENIC LOADING STARTS AT T-8 HOURS	COULD TARGET FOR ANY T-0 DESIRED WITHIN THE LUNAR OPPORTUNITY	WITHOUT SC CRYO RESERVICING <u>THE SV WOULD ESSENTIALLY</u> GO INTO AN EXTENDED HOLD FOR WHATEVER PERIOD OF TIME DESIRED TO TARGET FOR A NEW T-0 SINCE SC CRYO REDLINES ALLOW FOR LAUNCH DELAYS IN EXCESS OF FIVE DAYS.
		61 1/4 HOURS	WITH SC CRYO RESERVICING <u>24 1/4 HOURS OF RECYCLE</u> ACTIVITY ARE REQUIRED PRIOR TO RESUMING THE COUNTDOWN AT T-37 HOURS.

*Turnaround time is defined as the total time required to recycle and count down the SV to a new T-0 subsequent to a scrub decision.

TABLE 5 (CONT'D)

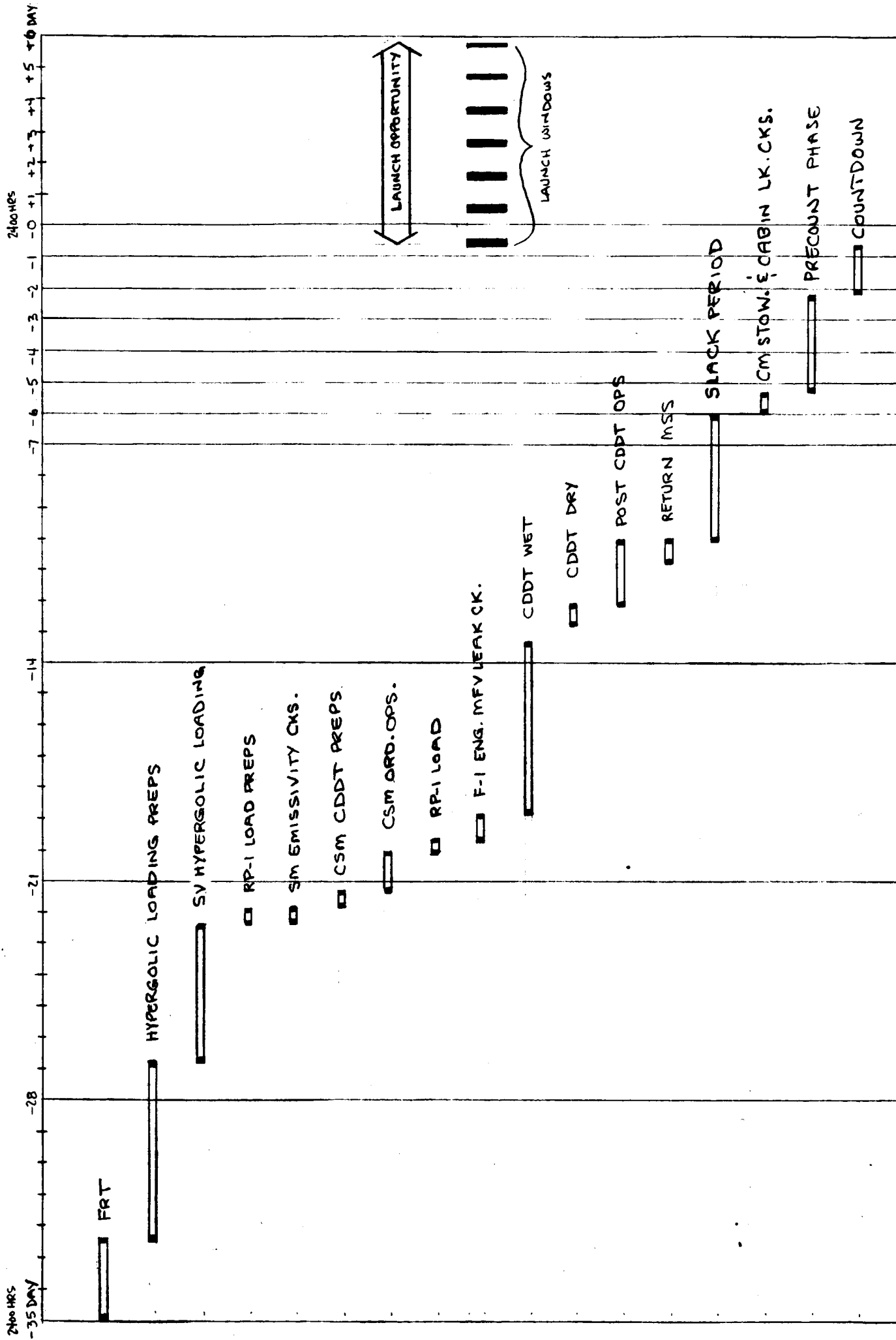
APOLLO 8 SV SCRUB TURNAROUND TIME

<u>T-TIME OF SCRUB</u>	<u>DETERMINING EVENT</u>	<u>TURNAROUND TIME*</u>	<u>CRITERIA</u>
AFTER T-8 HOURS BUT PRIOR TO T-8.9 SECONDS	IGNITION OCCURS AT T-8.9 SECONDS	30 1/4 HOURS	WITHOUT SC CRYO RESERVICING 21 1/4 HOURS OF RECYCLE ACTI- VITY ARE REQUIRED PRIOR TO RESUMING THE COUNTDOWN AT T-9 HOURS.
		67 1/2 HOURS	WITH SC CRYO RESERVICING 30 1/2 HOURS OF RECYCLE ACTIVITY ARE REQUIRED PRIOR TO RESUMING THE COUNTDOWN AT T-37 HOURS.

NOTE:

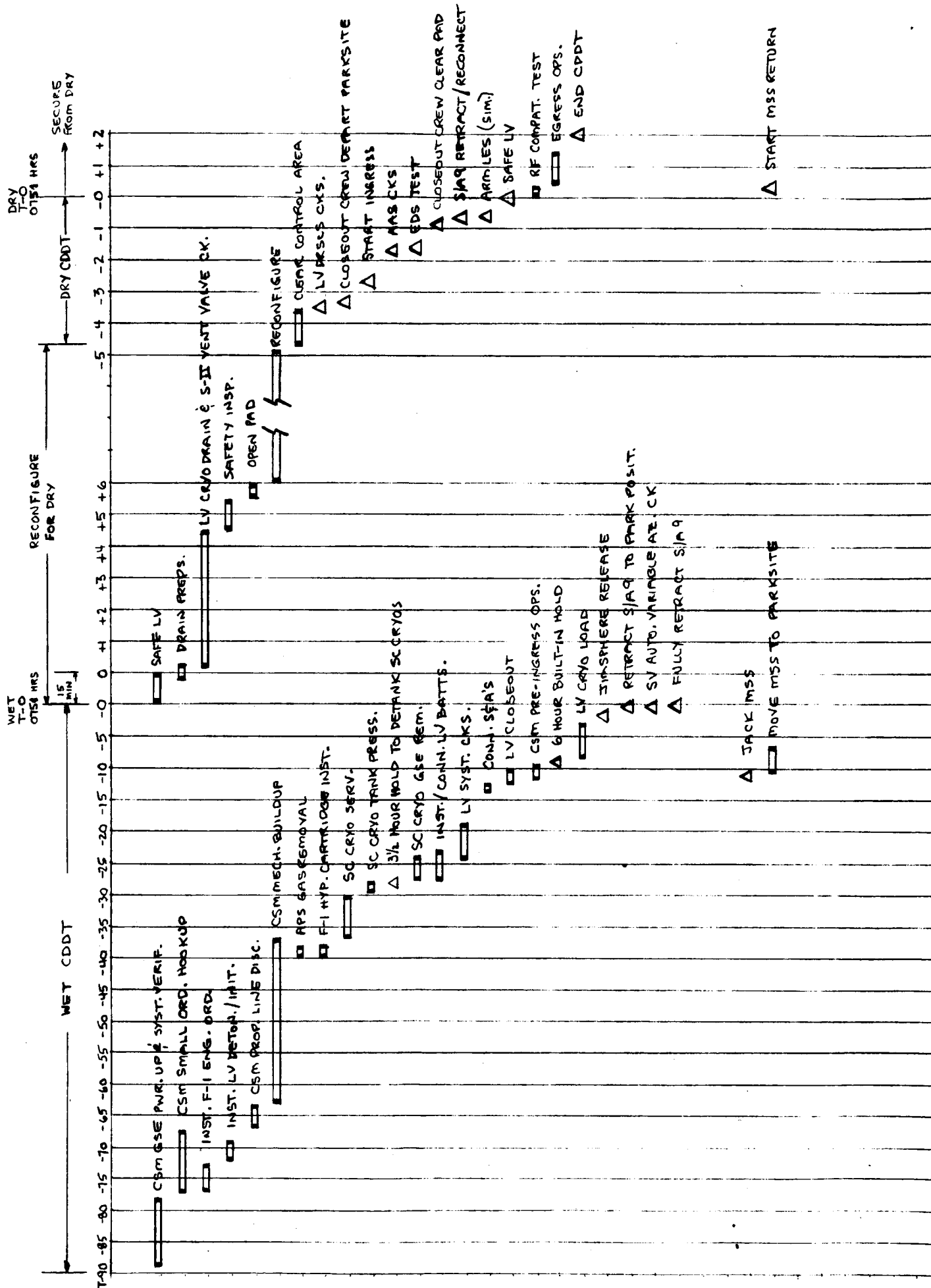
The turnaround times indicated are of a preliminary nature and are subject to revision.
Real-time decisions may also affect actual turnaround times.

*Turnaround time is defined as the total time required to recycle and count down the SV to a new T-0 subsequent to a scrub decision



AS-503/CSM103 PAD PROCESSING

FIGURE 1



AS-503/CSM 103 WET/DRY CDDT PHASE
FIGURE 2

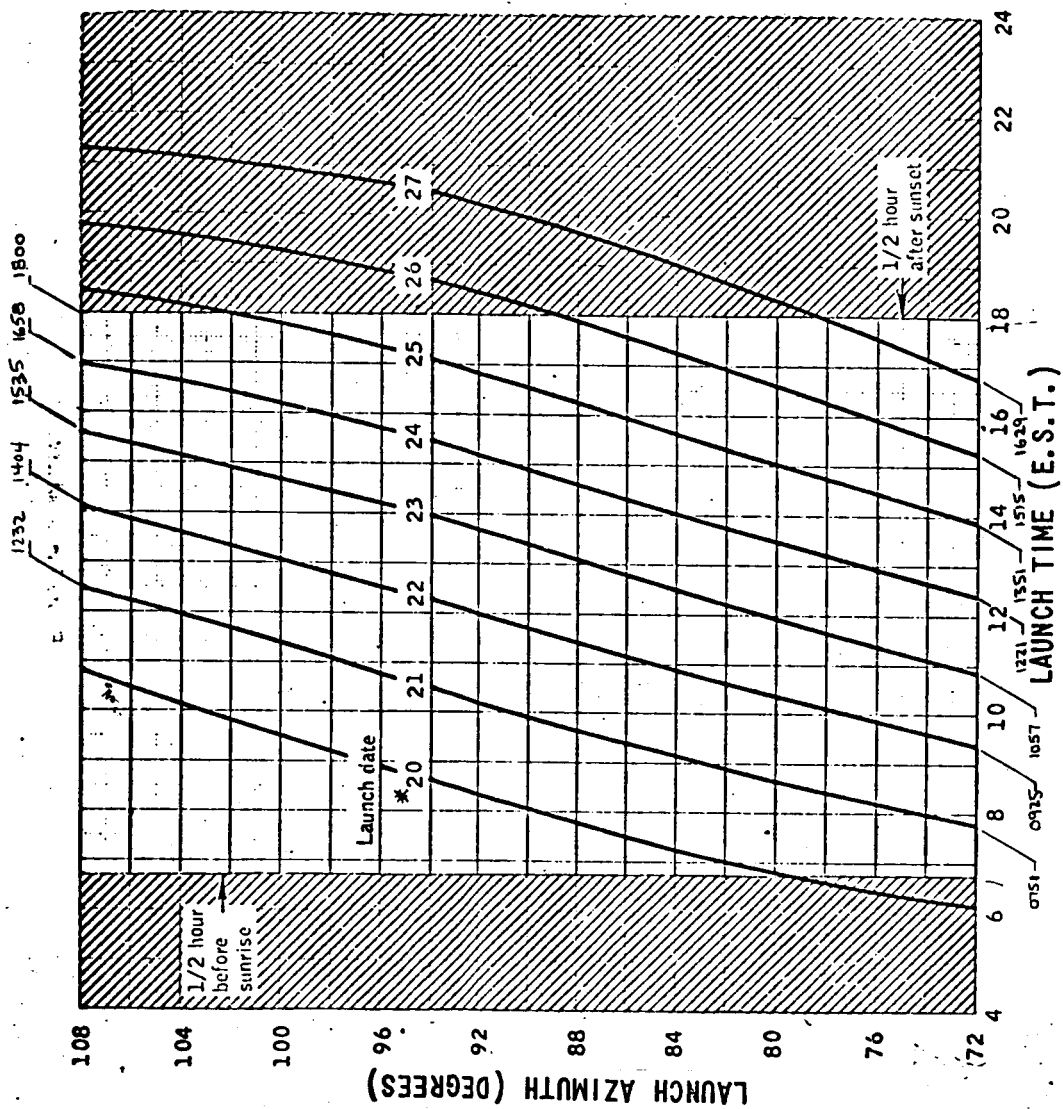
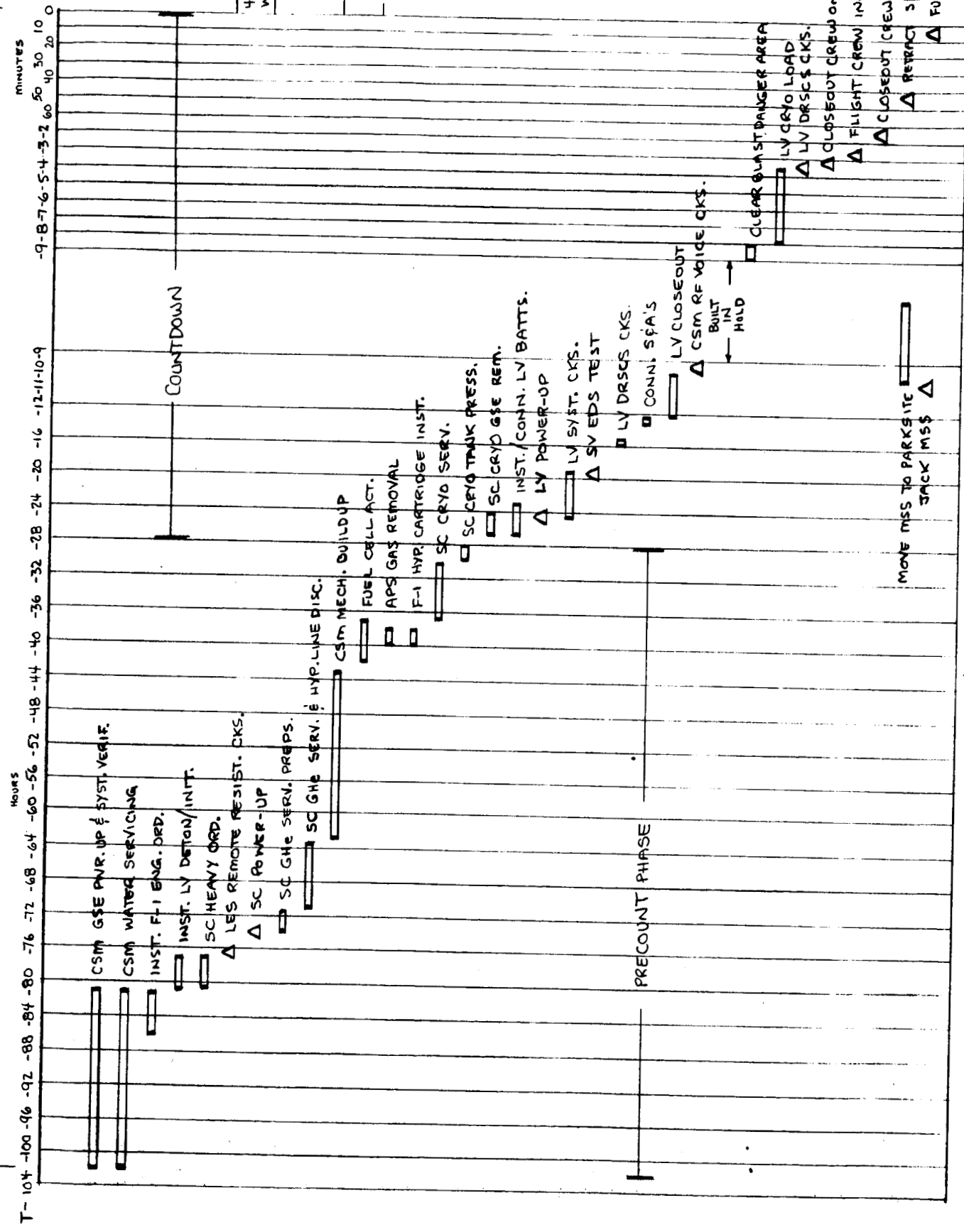


FIGURE 3 - DECEMBER LAUNCH OPPORTUNITY

1951 HAS
 T-102:00
 T-91:51
 L-5 DAY
 T-73:51
 L-4 DAY
 T-49:51
 L-3 DAY
 T-25:51
 L-2 DAY
 T-7:51
 L-1 DAY
 L DAY
 T-0
 0750 HAS



AS-503/CSM 103 LAUNCH COUNTDOWN PHASE
FIGURE 4

BELLCOMM, INC.

Subject: AS-503/CSM 103 (Apollo 8)
Launch Preparations, Launch
Countdown, and Flight Sequence
of Events - Case 320

From: G. J. McPherson Jr.

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SUBJECT: Up-date of Memo -
AS-503/CSM 103 (Apollo 8)
Launch Preparations, Launch
Countdown, and Flight Sequence
of Events - Case 320

DATE: December 12, 1968

FROM: G. J. McPherson Jr.

Make the following changes to the referenced memo:

TABLE 3:

<u>Add</u> new item at	T-81:00:00	6-hour built-in hold
<u>Add</u> new item at	T-63:00:00	5-hour built-in hold
<u>Add</u> new item at	T-47:00:00	Transport LH ₂ dewar to pad
<u>Add</u> new item at	T-42:00:00	6-hour built in hold
<u>Add</u> new item at	T-41:15:00	LH ₂ dewar connection complete
<u>Add</u> new item at	T-28:00:00	6-hour built-in hold
<u>Was</u> T-0:00:17.2, <u>now</u> T-00:00:17		Guidance reference release command
<u>Was</u> T-0:00:16.7, <u>now</u> T-00:00:16.2		S/A #2 retract command
<u>Was</u> T+02:50:33.1 <u>now</u> T+02:50:31.2		S-IVB engine restart sequence initiate (TLI burn)
<u>Was</u> T+02:55:55.2, <u>now</u> T+02:55:40.4		S-IVB point level sensor arming
<u>Was</u> T+02:55:57.4, <u>now</u> T+02:55:42.6		(TB-7)
<u>Was</u> T+02:55:57.5, <u>now</u> T+02:55:42.7		S-IVB engine cutoff (TLI burn cutoff)

FIGURE 3:

Revise the listed window open and close times to read as follows:

	<u>Open</u>	<u>Close</u>
Dec. 22	0926	1405
Dec. 23	1058	
Dec. 25	1352	
Dec. 27	1645	

2032-GJM-lmc



G. J. McPherson Jr.

BELLCOMM, INC.

Subject: Up-date of Memo -
AS-503/CSM 103 (Apollo 8)
Launch Preparations, Launch
Countdown, and Flight Sequence
of Events - Case 320

From: G. J. McPherson Jr.

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